MATHS

BOOKS - ARIHANT PUBLICATION

THREE-DIMENSIONAL GEOMETRY

Sample Questions

1. If a line makes angles $90^\circ, 135^\circ, 45^\circ$ with the X, Y and Z-axes, respectively. Find its direction cosines.

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2. Find the direction cosines of a line which makes equal angles with the coordinate axes.

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3. If a line has direction ratios 2, -1, 2, then determine its direction cosines.

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4. Find the direction ratios and direction cosines of the line passing through two points (2, -4, 5) and (0, 1, -1).

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5. Find the angle between the lines whose dr's are (4, -3, 5) and (3, 4, 5).

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6. Prove that the two lines whose direction cosines are connected by the equations $l + 2m + 3n = 0, 3lm - 4\ln + mn = 0$ are perpendicular to each other.

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7. A line makes angles $\alpha, \beta, \gamma, \delta$ with the four main diagonals of a cube. Prove that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}$

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8. Show that the points A(2, 3, -4), B(1, -2, 3) and C(3, 8, -11) are collinear.

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9. Evaluate the following integrals :

$$\int x^3 dx$$

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10. Find the cartesian equation of a plane which is at a distance of 6 units from the origin and

which has a normal with direction ratios (2, -1, -2).

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11. Find the direction cosines of the unit vector, perpendicular to the given plane $r.\left(3\hat{i}-5\hat{j}+3\hat{k}\right)+3=0$, passing through the origin.

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12. Find the vector equation of the plane which is at a distance of $\frac{4}{\sqrt{5}}$ unit from the origin and its normal vector from the origin is $3\hat{i} - 4\hat{j} + 5\hat{k}$. Also, find the cartesian equation of the plane.

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13. Find the distance of the plane $2x - 3y + 4z - 6 = 0$ from the origin and the coordinates of the foot of the perpendicular drawn from origin to the given plane.

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14. Find vector equation of a plane passing through a point having position vector $\left(2\hat{i}-\hat{j}+\hat{k}\right)$ and perpendicular to the vector $\left(4\hat{i}+2\hat{j}-3\hat{k}\right)$.

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15. Find the vector and cartesian equation of the plane, which passes through the point (5, 2, -4)

and perpendicular to the line with direction ratios (2, 3, -1).

16. Find the vector equation of the plane passing through the points R(2, 5, -3), S(-2, -3, 5) and T(5, 3, -3).

17. Prove that the four points (0, 4, 3), (-1, -5, -3), (-2, -2, 1) and (1, 1, -1) lie in one plane. Find the equation of the plane.

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18. Find the equation of the plane with intercept 2, 3 and 4 on the X, Y and Z-axes, respectively.

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19. Reduce the equation of the plane $4x + 3y - 6z - 12 = 0$ into intercept form and find its intercepts on the coordinate axes.

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20. Find the angle between the planes whose vector equations are $r.\left(2\hat{i} + 2\hat{j} - 3\hat{k}\right) = 5$ and $r.\left(3\hat{i} - 3\hat{j} + 5\hat{k}\right) = 3.$

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21. Find the angle between the two planes $3x - 6y + 2z - 7 = 0$ and $2x + 2y - 2z - 5 = 0.$

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22. Find the vector equation of the plane passing through the intersection of the planes $\vec{r}.\left(\hat{i} + \hat{j} + \hat{k}\right) = 6$ and $\vec{r}.\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right) = -5$ and the point (1, 1, 1).

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23. Find the vector equation of the plane passing through the intersection of the planes $\vec{r}.\left(\hat{i}+\hat{j}+\hat{k}\right)=6$ and $\vec{r}.\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=-5$ and the point (1, 1, 1).

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24. Find the equation of the plane parallel to the plane $3x-2y+z+5=0$ and passing through the point (1, 1, 2).

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25. Find the distance of a point (2, 2, -1) from the vector equation of plane $r.\left(3\hat{i}-3\hat{j}+5\hat{k}\right)=7.$

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26. Find the distance of a point (2, 2, -1) from the cartesian equation of plane is $3x-3y+5z=7$.

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27. Find the distance between the following parallel planes.

$2x - y + 2z + 3 = 0$ and

$4x - 2y + 4z + 5 = 0$

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28. Find the bisector of the acute angle between the plane.

$3x - 6y + 2z + 5 = 0$ and

$4x - 12y + 3z - 3 = 0.$

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29. Find the vector and the cartesian equations of the line passing through the point (5, 2, -4) and which is parallel to the vector $5\hat{i} + \hat{j} - 7\hat{k}$.

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30. Find the cartesian and vector equation for the line passing through the points A(-1, 1, 2) and B(2, 4, 5).

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31. Prove that the lines $\frac{x-2}{1}=\frac{y-4}{4}=\frac{z-6}{7}$ and $\frac{x+1}{3}=\frac{y+3}{5}=\frac{z+5}{7}$ are coplanar.

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32. Show that lines $\vec{r}=\left(\hat{i}+\hat{j}-\hat{k}\right)+\lambda\left(3\hat{i}-\hat{j}\right)$ and $\vec{r}=\left(4\hat{i}-\hat{k}\right)+\mu\left(2\hat{i}+3\hat{k}\right)$ intersect each other. Find their point of intersection.

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33. Show that the lines $\frac{x+1}{3}=\frac{y+3}{5}=\frac{Z+5}{7}$ and $\frac{x-2}{1}=\frac{y-4}{3}=\frac{z-6}{5}$ intersect. Also, find their point of intersection.

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34. Find the angle between the lines

$r=2\hat{i}-5\hat{j}+\hat{k}+\lambda\left(3\hat{i}+2\hat{j}+6\hat{k}\right)$ and $r=7\hat{i}-6\hat{k}+\mu\left(\hat{i}+2\hat{j}+2\hat{k}\right).$

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35. Find the angle between the lines

$$\frac{x}{2}=\frac{y}{2}=\frac{z}{1} \text{ and } \frac{x-5}{4}=\frac{y-2}{1}=\frac{z-3}{8}.$$

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36. Find the angle between the line $\vec{r}=\left(-\hat{i}+3\hat{k}\right)+\lambda\left(2\hat{i}+3\hat{j}+6\hat{k}\right)$ and plane $\vec{r}.\left(10\hat{i}+2\hat{j}-11\hat{k}\right)=3.$

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37. Find the coordinates of foot of perpendicular drawn from the point (0, 2, 3) on the line $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}$. Also, find the length of perpendicular.

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38. Find the shortest distance between the lines $r = (1+\lambda)\hat{i} + (2-3\lambda)\hat{j} + (3+2\lambda)\hat{k}$ and $r = \left(4\hat{i} + 5\hat{j} + 6\hat{k}\right) + \mu\left(2\hat{i} + 3\hat{j} + \hat{k}\right)$.

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39. Find the shortest distance between the lines

$$\frac{1-x}{-2}=\frac{2-y}{-3}=\frac{z-3}{4}$$

and

$$\frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$$

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40. Find the distance between the lines L_1 and L_2 given by

$$r=\hat{i}+2\hat{j}-4\hat{k}+\lambda\left(2\hat{i}+3\hat{j}+6\hat{k}\right)$$

and

$$r=3\hat{i}+3\hat{j}-5\hat{k}+\mu\left(4\hat{i}+6\hat{j}+12\hat{k}\right).$$

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Part I Questions For Practice Direction Cosines And Direction Ratios Of A Line Very Short Answer Type Questions

1. If a line makes angles $90^\circ, 60^\circ$ and 30° with the positive direction of X, Y and Z-axes respectively, then find its direction cosines.

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2. Write the direction cosines of a line parallel to Z-axis.

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3. A line makes angles 60° and 45° with the positive direction of X-axis and Y-axis, respectively. What acute angle does it make with the Z-axis?

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4. Find the position vector of a point A in space such that $\overrightarrow{OA}$ is inclined at 60° to OX and at 45° to OY and $|\overrightarrow{OA}|$= 10 units.

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5. If a line makes angles α, β and γ with the positive direction of coordinate axes, then write the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$.

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6. If a line in the space makes angles α, β and γ with the coordinate axes, then find the value of $\cos 2\alpha + \cos 2\beta + \cos 2\gamma + \sin^2\alpha + \sin^2\beta + \sin^2\gamma$

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7. Find the direction cosines of the line segment joining the points A(7, -5,9) and B (5,-3,8).

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8. Find the direction cosines of a line whose direction ratios are 2-6, 3.

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9. Find the direction ratios of a line whose direction cosines are $\frac{1}{2}, \frac{1}{\sqrt{2}}, \frac{1}{2}$.

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10. If P(1, 5, 4) and Q(4, 1, -2), then find the direction ratios of $\overrightarrow{PQ}$.

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11. Find the angle between the vectors with direction ratios proportional to (4, -3, 5) and (3,4,5).

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Part I Questions For Practice Direction Cosines And Direction Ratios Of A Line Short Answer Type Questions

1. Find the angle between the lines whose direction cosines are given by the equations.

$3l + m + 5n = 0, 6mn - 2nl + 5lm = 0.$

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2. Show that the points $P(1, 2, -5)$, $Q(0, -3, 2)$ and $R(-1, -8, 9)$ are collinear.

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3. If A (1,0,-1), B (-2,4,-2) and C(1,5,10) be the vertices of a triangle and the bisector of the

angle BAC, meets BC at D, then find the coordinates of the point D.

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4. Find the coordinates of the foot of the perpendicular from the points (1, 0, -2) on the line joining (-2,4,-2) and (1, 5, 10).

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5. Determine the direction cosines of the normal to the plane x + y + z =1and the distance from the origin.

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Part Ii Questions For Practice Plane Very Short Answer Type Questions

1. Find the vector and cartesian equation of the planes that passes through the point (1, 0, -2) and the normal to the plane is $\hat{i} + \hat{j} - \hat{k}$.

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2. Find the vector equation of a plane which is at a distance of 7 units from the origin and normal to the vector $3\hat{i} + 5\hat{j} - 6\hat{k}$.

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3. Write the distance of the plane $3x - 4y + 12z = 3$ from the origin.

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4. Write the vector equation of the plane passing through the point (a, b, c) and parallel to the plane $r.\left(\hat{i}+\hat{j}+\hat{k}\right)=2$.

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5. Write the intercepts cutoff by the plane 2x+y-z =5 on three axes.

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6. Find the equation of the plane with intercept 3 on the Y-axis and parallel to ZOX-plane.

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7. Find the distance of the point whose position vector is $\left(2\hat{i}+\hat{j}-\hat{k}\right)$ from the plane $r.\left(\hat{i}-2\hat{j}+4\hat{k}\right)=9.$

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8. Check whether the given planes are parallel or perpendicular

$2x + y + 3z - 2 = 0$ and $x - 2y + 5 = 0$.

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9. Check whether the given planes are parallel or perpendicular

$2x - 2y + 4z + 5 = 0$ and $3x - 3y + 6z - 1 = 0$.

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10. What is the image of the point (—2, 3, —5) respect to the zx-plane ?

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11. How many independent constants are there in the general equation of a plane $ax + by + cz + d = 0$?

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12. Write the equation of the plane passing through the point(1,-2,3)and perpendicular to the y-axis.

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13. To which coordinate axis is the plane $2x + 3z = 0$ parallel ?

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14. What is the image of the point (6, 3, -4) with respect to yz- plane ? '

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15. Write the equation of the plane passing through the point (2,3,5) and perpendicular to Y-axis.

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16. Find the distance between the parallel planes

3x - 2y + 6z - 7 = 0 and 3x- 2y + 6z + 14 = 0.

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17. Find the equation of the plane Paralel to the plane $2x - y + 3z + 1 = 0$ and at a distance 3 units away from it.

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Part Ii Questions For Practice Plane Short Answer Type Questions

1. Find the vector and cartesian equation of the plane that passes through the point (1, 4, 6) and the normal vector to the plane is $\hat{i} - 2\hat{j} + \hat{k}$.

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2. Find the equation of the plane through the point P(1, 4,-2) and it is parallel to the plane $-2x + y - 3z = 0$.

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3. Find the equation of the plane that passes through the points (1,1,0), (1, 2, 1) and (-2,2-1).

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4. Find the equation of the plane passing through the intersection of the planes $2x + y + 3z - 7 = 0$ and $2x + 5y + 3z - 9 = 0$ and the point (2,1,3).

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5. Find the equation of the plane which is perpendicular to the plane $5x + 3y + 6z + 8 = 0$ and which contains the line of intersection of the planes $x + 2y + 3z - 4 = 0$ and 2x + y - z + 5 = 0`.

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6. Find the vector equation of the plane which contains the line of intersection of the planes $\vec{r} \cdot \left(\hat{i} + 2\hat{j} + 3\hat{k}\right) - 4 = 0$ and

$\vec{r}.\left(2\hat{i}+\hat{j}-\hat{k}\right)+5=0$ and which is perpendicular to the plane $\vec{r}.\left(5\hat{i}+3\hat{j}-6\hat{k}\right)+8=0.$

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7. Find the distance between the parallel planes $r.\left(2\hat{i}-\hat{j}-2\hat{k}\right)=6$ and $r.\left(6\hat{i}-3\hat{j}-6\hat{k}\right)=27.$

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8. Find the vector equation of the plane through the points (2,1, -1) and (-1, 3, 4) and .. perpendicular to the plane $x - 2y + 4z = 10$.

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9. A variable plane is at a constant distance 3r from the origin and meets the axes in A, B and C. Show that the locus of the centroid of the ΔABC is $x^{-2} + y^{-2} + z^{-2} = r^{-2}$.

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Part Ii Questions For Practice Plane Long Answer Type Questions

1. Evaluate the following integrals :

$$\int x^7 dx$$

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2. Find the equation of the plane through the line of intersection of the planes $x + y + z = 1$ and $2x + 3y + 4z = -5$, which is perpendicular to the plane $x - y + z = 0$.

Also, find the distance of the plane obtained above, from the point A (1 3,6).

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3. Find the equation of the plane through the intersection of the planes $\vec{r}.\left(\hat{i}+3\hat{j}\right)-6=0$ and $\vec{r}.\left(3\hat{i}-\hat{j}-4\hat{k}\right)=0,$ whose perpendicular distance from origin is unity.

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4. Find the direction cosines of the line $\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}$

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Part Iii Questions For Practice Lines In Space Very Short Answer Type Questions

1. The equation of a line are $5x - 3 = 15y + 7 = 3 - 10z$, Write the direction cosines of the line.

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2. Find the vector equation of the line which is parallel to the vector $3\hat{i} - 2\hat{j} + 6\hat{k}$ and which passes through the point (1, -2,3).

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3. Find the cartesian equation of the line which passes through the point (-2,4,-5) and is parallel to the line $\frac{x+3}{3} = \frac{4-y}{5} = \frac{z+8}{6}$.

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4. If the cartesian equation of a line is $\frac{3-x}{5} = \frac{y+4}{7} = \frac{2z-6}{4}$ then write the corresponding vector equation of the line.

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5. Find the equation of a line in cartesian form, which is parallel to $2\hat{i} - \hat{j} + 3\hat{k}$ and which passes through the point (5, -2, 4).

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6. Find the vector equation of line passing through the points (1 – 1, 2) and (3, 2, 1).

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7. Find the cartesian equation of line that passing through the points (1,-1, 3) and (3, 4, -2).

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8. Find the number of points (x, y, z) in space other than the point (1,-2, 3), such that |x| = 1, |y|

= 2 and $|z|= 3$.

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9. How many straight lines in space through the origin are equally inclined to the coordinate axes?

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10. Write the equation of the line passing through the point (4, -6, 1) and parallel to the

line $\frac{x-1}{1}=\frac{y+2}{3}=\frac{z-1}{-1}$.

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11. Find the value of k for which the line $\frac{x-2}{3}=\frac{1-y}{k}=\frac{z-1}{4}$ is parallel to the plane 2x + 6y + 3z - 4 = 0.

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12. The angle between the plane $3x+3z-5=0$ and the line

$\frac{x-1}{1} = \frac{y-2}{-1} = \frac{z-3}{0}$ is.

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13. Write the vector equation of the line passing through the point (1, 2, 3) and perpendicular to the plane $r.\left(\hat{i}+2\hat{j}-5\hat{k}\right)+9=0.$

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14. Find the value of λ, şuch that the line $\frac{x-2}{6} = \frac{y-1}{\lambda} = \frac{z+5}{-4}$ is perpendicular to

the plane $3x - y - 2z = 7$.

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15. Find the equation of the plane, that passes through the point (-1,3,0) and is perpendicular to the line through the points (1, 1, 1) and (2,-1,-2).

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16. Under which conditions the straight line $\frac{x-a}{l} = \frac{y-b}{m} = \frac{z-c}{n}$ intersects the plane

$Ax + By + Cz = 0$ at a point other than (a,b,c)?

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17. Find the point of intersection of the line $2x - 4 = 3y = z$ with plane $x + y + z = 13$.

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18. Show that the line $\frac{x-1}{1} = \frac{y+2}{3} = \frac{z-1}{-1}$ lies on the plane

$2x + y + 5z = 5.$

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19. Find the point where the line $\frac{x-2}{1} = \frac{y}{-1} = \frac{z-1}{2}$ meets the plane $2x + y + z = 2.$

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20. What is the point of intersection of the line x = y = z with the plane x + 2y + 3z = 6?

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21. Proved that the line $\frac{x-1}{2}=\frac{y+2}{-3}=\frac{z-3}{1}$ lies on the plane $7x+5y+z=0$

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22. Find the coordinates of the points of intersection of the line $3x-3=y+2=3-3z$ and the plane $2x+y+z=9.$

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23. Find the co-ordinates of the foot of the perpendicular from the point $(1, 1, 1)$ on the line joining $(1, 4, 6)$ and $(54, 4)$.

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Part Iii Questions For Practice Lines In Space Short Answer Type Questions

1. Evaluate the following integrals :

$$\int\left(\frac{x^2}{\sin x^3}\right)dx$$

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2. Find the co-ordinates of the point where the perpendicular from the origin meets the line joining the points $(-9, 4, 5)$ and $(11, 0, -1)$.

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3. Show that the lines at $\frac{5-x}{-4}=\frac{y-7}{4}=\frac{z+3}{-5}$ and $\frac{x-8}{7}=\frac{2y-8}{2}=\frac{z-5}{3}$ are coplanar.

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4. Find the points on the line $\frac{x+2}{3}=\frac{y+1}{2}=\frac{z-3}{2}$ at a distance of 5 units from the point P(1, 3, 3).

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5. The cartesian equations of a line is $6x - 2 = 3y + 1 = 2z - 2$. Find the direction cosines of the line. Write down the cartesian and vector equations of a line passing through the point (2-1, -1) which are-parallel to the given line.

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6. Show that the line through the points (1 - 1,2), (3, 4,-2) is perpendicular to the line through the points (0, 3, 2) and (3,5, 6).

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7. Find the equation of a linę passing through the point (1, 2 - 4) and perpendicular to two lines

$$\vec{r} = \left(8\hat{i} - 19\hat{j} + 10\hat{k}\right) + \lambda\left(3\hat{i} - 16\hat{j} + 7\hat{k}\right)$$

and

$$\vec{r} = \left(15\hat{i} + 29\hat{j} + 5\hat{k}\right) + \mu\left(3\hat{i} + 8\hat{j} - 5\hat{k}\right).$$

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8. Find the vector and cartesian equations of the line passing through the point (2, 1, 3) and perpendicular to the lines $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$ and $\frac{x}{-3} = \frac{y}{2} = \frac{z}{5}$.

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9. Find the vector and cartesian equation of a line through the point (1, -1, 1) and perpendicular to the lines joining the points (4, 3, 2), (1,-1,0) and (1, 2, -1), (2, 1, 1).

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10. Find the foot of the perpendicular from (1, 2 , - 3) to the line $\frac{x+1}{2} = \frac{y-3}{-2} = \frac{z}{-1}$.

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11. Find the shortest distance between the following lines

$\vec{r} = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$ and

$\vec{r} = 7\hat{i} - 6\hat{k} + \mu\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$

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12. Find the shortest distance between the lines

$$\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$$ and

$\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$.

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13. By computing shortest distance, determine whether the following pair of lines intersect or not $\vec{r} = \left(4\hat{i} + 5\hat{j}\right) + \lambda\left(\hat{i} + 2\hat{j} - 3\hat{k}\right)$ and $\vec{r} = \left(\hat{i} - \hat{j} + 2\hat{k}\right) + \mu\left(2\hat{i} + 4\hat{j} - 5\hat{k}\right)$.

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14. Show that the $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-1}{5}$ and $\frac{x+2}{4} = \frac{y-1}{3} = \frac{z+1}{-2}$ do not intersect each other.

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15. Find the equation of the plane passing through the line $x = y = z$ and the point $(3,2,1)$.

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16. Find the image of the point $(-2,0,3)$ with respect to the plane $y = 3$.

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17. Find the value of r, if the line $\frac{x-1}{1} = \frac{y+2}{3} = \frac{z-1}{-1} = r$ rintersects the plane $2x + y + z = 9$.

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18. Determine the symmetric form of the equation to the line of intersection of the plane $y + 2z + 1 = 0$ and $x - 2y - 2 = 0$.

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19. Evaluate the following integrals :

$$\int (\sin x + x^2)\, dx$$

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Part Iii Questions For Practice Lines In Space Long Answer Type Questions

1. Evaluate the following integrals :

$$\int (\tan x + x^2)\, dx$$

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2. Evaluate the following integrals :

$$\int \left(\tan x + x e^{x^2} \right) dx$$

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3. Prove that the lines $x = py + q, z = ry + s$ and $x = p'y + q, z = r'y + s'$ are perpendicular, if pp' + rr' +1=0.

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4. Find the angle between the lines $r = 3\hat{i} - 2\hat{j} + 6\hat{k} + \lambda\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$ and $r = 2\hat{j} - 5\hat{k} + \mu\left(6\hat{i} + 3\hat{j} + 2\hat{k}\right)$.

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5. Find the angle between the lines $\vec{r} = \lambda\left(\hat{i} + \hat{j} + 2\hat{k}\right)$ and $\vec{r} = 2\hat{j} + \mu\left\{\left(\sqrt{3} - 1\right)\hat{i} - \left(\sqrt{3} + 1\right)\hat{j} + 4\hat{k}\right\}$.

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6. Find the angle between the pair of lines

$$\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{4}$$

and

$$\frac{x+1}{1} = \frac{y-4}{1} = \frac{z-5}{2}$$

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7. Find the angle between the lines 2x = 3y = -z and 6x = - y = - 4z

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8. Find the value of p, so that the lines

$l_1 : \frac{1-x}{3} = \frac{7y-14}{p} = \frac{z-3}{2}$

and $l_2 : \frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are perpendicular to each other. Also, find the equation of a line passing through a point (3,2, -4) and parallel to line l_1.

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9. Show that the lines $\frac{x-1}{3} = \frac{y-1}{-1} = \frac{z+1}{0}$ and

$\frac{x-4}{2} = \frac{y}{0} = \frac{z+1}{3}$ intersect each other.

Also, find their point of intersection.

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10. Find the shortest distance between the lines

$$\frac{x-8}{3} = \frac{y+9}{-16} = \frac{z-10}{7}$$ and

$$\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}.$$

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11. Find the perpendicular distance of point (1,0,0) in from the lines $\frac{x-1}{2}=\frac{y+1}{-3}=\frac{z-10}{8}$ and `(x coordinate of foot of perpendicular and equation of perpendicular.

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12. Find a symmetric form of the equation to the lines $x+2y-z-2=0$ and $2x-y+3z-4=0.$

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13. Find the distance of the point $(1, -2, 3)$ from the plane $x - y + z = 5$, measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$

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14. Find the distance of the point (2, 3, 4) from the plane $3x + 2y + 2z + 5 = 0$ measured parallel to the line $\frac{x+3}{3} = \frac{y-2}{6} = \frac{z}{2}$

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15. If line $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}$ and $\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}$ intersect, then find the value of k and also find the equation of plane containing these lines.

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Odisha Bureau S Textbooks Solutions Exercise 13 A Fill In The Blanks

1. The number of lines making equal angles with coordinate axes is ..... [1,2,4,8]

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2. Fill in the blanks in the length of the projection of the line segment joining (1,3,-1) and (3,2,4)on z-axis is _____.

$[1, 3, 4, 5]$

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3. If a line is perpendicular to z-axis and makes an angle measuring 60^0 with x-axis, then the angle it makes with y-axis measures____.

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4. If the distance between the points (-1, -1, z) and (1, -1, 1) is 2 then z =_____.

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Odisha Bureau S Textbooks Solutions Exercise 13 A True T Or False F

1. The line through $(1, -1, 2)$ and $(-2, -1, 2)$ is always perpendicular to z-axis.

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2. The line passing through $(0, 0, 0)$ and $(1, 2, 3)$ has direction cosines $(-1, -2, -3)$

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3. If α, β, γ be any three arbitrary angles then $\cos\alpha, \cos\beta, \cos\gamma$ can always be considered as the direction cosines of a line.

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4. If two lines are perpendicular to a third line, then the direction ratios of the two lines are proportional.

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Odisha Bureau S Textbooks Solutions Exercise 13 A

1. Show that the points (3,-2,4)(1,1,1) and (-1,4,-1) are collinear.

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2. Show that points (0,1,2),(2,5,8),(5,6,6) and (3,2,0) from a parallelogram.

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3. Find the co-ordinates of the foot of the perpendicular from the point $(1, 1, 1)$ on the line joining $(1, 4, 6)$ and $(54, 4)$.

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4. Find the co-ordinates of the point where the perpendicular from the origin meets the line joining the points $(-9, 4, 5)$ and $(11, 0, -1)$.

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5. Prove that the points P(3,2,-4),Q(5,4,-6) and R(9,8:-10) are collinear. Find the ratio in which the point Q divides the line segment PR.

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6. If P $(1, y, z)$ lies on the line through $(3, 2, -1)$ and $(-4, 6, 3)$ find y & z.

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7. If A, B, C, D are the points $(6, 3, 2), (3, 5, 7), (2, 3, -1)$ and $(3, 5, -3)$ respectively, then find the projection of $\overline{AB}$ on $\overleftrightarrow{CD}$

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8. The projection of a line segment $\overline{OP}$, through origin O, on the co-ordinate axes are 6, 2, 3. Find the length of the line segment OP and its direction cosines.

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9. The projection of a line segment of x, y and z-axis respectively are 12, 4, 3.Find the length and the direction cosines of the line segment.

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10. If A, B, C are the points $(1, 4, 2), (-2, 1, 2)$ and $(2, -3, 4)$ respectively then find the angles of the triangle ABC.

Watch Video Solution

11. Find the acute angle between the lines passing through $(-3, -1, 0), (2, -3, 1)$ and $(1, 2, 3), (-1, 4, -2)$ respectively.

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12. Prove that the measure of the angle between two main diagonals of a cube is $\cos^{-1}\frac{1}{3}$.

Watch Video Solution

13. Prove that the measure of the angle between two main diagonals of a cube is $\cos^{-1}\frac{1}{3}$.

Watch Video Solution

14. Find the angle which a diagonal of a cube makes with one of its edges.

Watch Video Solution

15. Find the angle between the lines whose dcs. L, m, n are connected by the relation, $3l + m + 5n = 0$ and $6mn - 2nl + 5lm = 0$

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16. If the edges of a rectangular parallelopiped are of lengths a, b, c, then the angle between four diagonals are $\cos^{-1}\left(\frac{\pm a^2 \pm b^2 \pm c^2}{a^2 + b^2 + c^2}\right)$.

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17. If l_1, m_1, n_1 and l_2, m_2, n_2 are the direction cosines of two mutually perpendicular lines show that the Direction Cosines of the line perpendicular to both of them are $m_1n_2 - n_1m_2, n_1l_2 - l_1n_2, l_1m_2 - m_1l_2$

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Odisha Bureau S Textbooks Solutions Exercise 13 B True T Or False F

1. State Ture or False .Through any four points one and only one plane can pass.

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2. State True or False . The equation of xy-plane is $x + y = 0$.

Watch Video Solution

3. The plane $ax + by + c = 0$ is perpendicular to z-axis.

Watch Video Solution

4. The equation of the plane parallel to xz-plane and passing through $(2, -4, 0) is y + 4 = 0.$

Watch Video Solution

5. State True or False .The planes $2x - y + z - 1 = 0$ and $6x - 3y + 3z = 1$ are coincident.

Watch Video Solution

6. State true or False .The planes $2x + 4y - z + 1 = 0$ and $x - 2y - 6z + 3 = 0$ are perpendicular to each other.

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7. The distance of a point from a plane is same as the distance of the point from any line lying in that plane.

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8. The equation of a plane passing through $(1, 1, 2)$ and parallel to $x + y + z - 1 = 0$ is_____

Watch Video Solution

9. The equation of plane perpendicular to z-axis and passing through $(1, -2, 4)$ is____

Watch Video Solution

10. The distance between the parallel planes $2x - 3y + 6z + 1 = 0$ and $4x - 6y + 12z - 5 = 0$ is____

Watch Video Solution

11. The plane $y - z + 1 = 0$ is____

Watch Video Solution

12. A plane whose normal has direction ratios $< 3, -2, k >$ is parallel to the line joining

(-1,1,- 4) and (5,6,-2). Then the value of k =.....

[6,-4,-1,0]

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13. Find the equation of planes passing throught the points $(6, -1, 1)$, (5,1,2) and (1,-5,-4)`

Watch Video Solution

14. Find the equation of planes passing throught the points $(2, 1, 3)$, $(3, 2, 1)$ and $(1, 0, -1)$

Watch Video Solution

15. Find the equation of planes passing throught the points $(-1, 0, 1), (-1, 4, 2)$ and `(2,4,1)

Watch Video Solution

16. Find the equation of planes passing throught the points $(-1, 5, 4), (2, 3, 4)$ and $(2, 3, -1)$

Watch Video Solution

17. Find the equation of planes passing throught the points $(1, 2, 3), (1, -4, 3)$ and $(-1, 3, 2)$

Watch Video Solution

18. Find the equation of the plane .Passing through the point $(2, 3 - 1)$ and parallel to the plane $3x - 4y + 7z = 0.$

Watch Video Solution

19. Passing throughthe point $(2, -3, 1)$ and $(-1, 1-7)$ and perpendicular to the plane $x - 2y + 5z + 1 = 0$.

Watch Video Solution

20. Find the equation of the plane passing through the foot of the perpendiculars drawn from P(a,b,c) on the co-ordinate planes.

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21. passing through the point $(-1, 3, 2)$ perpendicular to the planes $x + 2y + 2z = 5$ and $3x + 3y + 2z = 8$.

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22. Bisecting the line segment joining $(-1, 4, 3)$ and $(5, -2, -1)$ at right angles.

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23. Find the equation of the plane Paralel to the plane $2x - y + 3z + 1 = 0$ and at a distance 3 units away from it.

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24. Write the equation of the plane $3x - 4y + 6z - 12 = 0$ in intercept from and hence obtain the co-ordinates of the point where it meets the co-ordinate axes.

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25. Write the equation of the plane $2x - 3y + 5z + 1 = 0$ in normal from and find its distance from the origin. Find also the distance between from the point (3,1,2).

Watch Video Solution

26. Find the distance between the parallel planes $2x - 2y + z + 1 = 0$ and $4x - 4y + 2z + 3 = 0.$

Watch Video Solution

27. In each of the following case, verift whether the four given points are coplanar or not. $(1, 2, 3), (-1, 1, 10), (2, 1, 3), (1, 1, 2)$

Watch Video Solution

28. In each of the following case, verift whether the four given points are coplanar or not. $(1, 1, 1), (3, 1, 2), (1, 4, 0), (-1, 1, 0)$

Watch Video Solution

29. In each of the following case, verift whether the four given points are coplanar or not. $(0, -1, -1), (4, 5, 1), (3, 9, 4), (-4, 4, 4)$

Watch Video Solution

30. In each of the following case, verift whether the four given points are coplanar or not. $(-6, 3, 2), (3, -2, 4), (5, 7, 3)$ and $(-13, 17, -1)$.

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31. Find the equation of the plane Passing through the intersection of planes $2x + 3y - 4z + 1 = 0.2x - y + z + 2 = 0$and passing through the point (3,2,1).

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32. Find the equation of the plane Which contains the line of intersection of the planes $x + 2y + 3z - 4 = 0$ and $2x + y - z + 5 = 0$ and perpendicular of the plane $5x + 3y + 6z + 8 = 0.$

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33. Find the equation of the plane Passing through the intersection of $ax + by + cz + d = 0$ and $a_1x + b_1y + c_1z + d_1 = 0$ perpendicular to xy-plane.

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34. Find the equation of the plane Passing through the intersection of the planes

$x + 3y - z + 1 = 0$ and $3x - y + 5z + 3 = 0$

and is at a distance $2/3$units from origin.

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35. Find the angle between the following pairs of

planes. $x + 3y - 5z + 1 = 0$ and

$2x + y - z + 3 = 0$

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36. Find the angle between the following pairs of planes. $x + 2y + 2z - 3 = 0$ and $3x + 4y + 5z + 1 = 0$

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37. Find the angle between the following pairs of planes. $x + 2y + 2z - 7 = 0$ and $2x - y + z = 6$

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38. Find the equation of the bisector of the angles between the following pairs of planes and specify the ones which bisects the acute angles , $3x - 6y + 2z + 5 = 0$ and $4x - 12y + 3z - 3 = 0$

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39. Find the equation of the bisector of the angles between the following pairs of planes and specify the ones which bisects the acute

angles , $2x + y - 2z - 1 = 0$ and $4x - 12y + 3z + 3 = 0$

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40. Show that the origin lies in the interior of the acute angle between planes. $x + 2y + 2z + 9$ and $4x - 3y + 12z + 13 = 0$, Find the equation of bisector of the acute angle.

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41. Prove that the line joining $(1, 2, 3), (2, 1, -1)$ intersects the line joining $(-1, 3, 1)$ and $(3, 1, 5)$.

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42. Show that the point $\left(-\frac{1}{2}, 2, 0\right)$ is the circumcentre of the triangle formed by the points $(1, 1, 0)(1, 2, 1)$ and $(-2, 2-1)$.

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43. Show that plane $ax + by + cz + d = 0$ divides the line segment joining (x_1, y_1, z_1) and (x_2, y_2, z_2) in a ratio $-\frac{ax_1 + by_1 + cz_1 + d}{ax_2 + by_2 + cz_2 + d}$

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44. A variable plane is at a constant distance p from the origin and meets the axes at A,B,C. Through A,B,C plane are drawn parallel to the co-ordinate planes. Show that the locus of their points of intersection is $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{p^2}$.

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45. A variable plane passes through a fixed point (a,b,c) and meets the co-ordinate axes at A,B,C. Show that the locus of the point common to the planes drawn through A,B and C parallel to the co-ordinate planes is $\frac{a}{x}+\frac{b}{y}+\frac{c}{z}=1$

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46. The plane $4x+7y+4z+81=0$ is rotated through a right angle about its line of

intersection with the plane $5x + 3y + 10z - 25 = 0$. Find the equation of the plane in new position.

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47. The plane $lx + my = 0$ is rotated about its line of intersection with the plane z=0 through angle measure alpha. Prove that the equation of the plane in new position is $lx + my \pm z\sqrt{l^2 + m^2}\tan\alpha = 0$

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Odisha Bureau S Textbooks Solutions Exercise 13 C True T Or False F

1. State which of the following statements are true (T) or false(F)

The line $\frac{x-1}{2}=\frac{y-1}{2}=\frac{z-1}{2}$ pass though the origin.

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2. State which of the following statements are true (T) or false(F)

The line $\frac{x+2}{-1}=\frac{y-3}{2}=\frac{z+4}{k}$ and

$\frac{x-4}{-4} = \frac{y-3}{k} = \frac{z+1}{2}$ are perpendicular at value of k=-1.

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3. State which of the following statements are true (T) or false(F)

The line $\frac{x+5}{-2} = \frac{y-3}{1} = \frac{z-2}{3}$ lies on the plane x-y+z+1=0.

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4. State which of the following statements are true (T) or false(F)

The line $\frac{x-2}{3}=\frac{1-y}{4}=\frac{5-z}{1}$ is parallel to the plane 2x -y-2z=0.

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5. State which of the following statements are true (T) or false(F)

The line $\frac{x+3}{-1}=\frac{y-2}{3}=\frac{z-1}{4}$ is perpendicular to the plane 3x-3y+3z-1=0

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6. What is the angle between the lines $\frac{x+2}{-4} = \frac{y+3}{5} = \frac{z-1}{3}$ and $\frac{1-x}{-4} = \frac{y-1}{5} = \frac{2-z}{3}$.

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7. The line passing through (-1,0,1) and perpendicular to the plane x+2y+1=0 is _____

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8. The line $\frac{x+1}{2} = \frac{y-6}{1} = \frac{z-4}{0}$ is_____

Watch Video Solution

9. If the line $\frac{x-3}{2} = \frac{y+k}{-1} = \frac{z+1}{-5}$ lies on the plane 2x-y+z-7 = 0,

then k = -$(2, -1, -2)$

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10. If l,m,n be d.cs, of a line ,then the line is perpendicular to the plane

$x - 3y + 2z + 1 = 0$ if _____.

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11. Find the equation of lines joining the points.

(4,-6,1) and (0,3,-1)

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12. Find the equation of lines joining the points.

(a,a,a) and (a,0,a)

Watch Video Solution

13. Find the equation of lines joining the points. (2,1,3) and (4,-2,5).

14. Write the symmetric form of equation of the following lines : x-axis

15. Write the symmetric form of equation of the following lines : y = b, z = c

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16. Write the symmetric form of equation of the following lines : $ax + by + d = 0, 5z = 0$

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17. Write the symmetric form of equation of the following lines : $x - 2y = 3, 2x + y - 5z = 0,$

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18. Write the symmetric form of equation of the following lines :

$4x + 4y - 5z - 12 = 0 = 8x + 12y - 13z - 32,$

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19. Write the symmetric form of equation of the following lines :

$3x - 2y + z = 1, 5x - 4y - 6z = 2.$

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20. Obtain the equation of the line through the point (1, 2, 3) and parallel to the line $x - y + 2z - 5 = 0, 3x + y + z = -6$

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21. Find the equation of the line through the point $(3, -1, 2)$ and parallel to the planes $x + y + 2z - 4 = 0$ and $2x - 3y + z + 3 = 0$

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22. Obtain the equation of the line through the point $(1, 2, -3)$ and perpendicular to each of the lines $x + 4y - 3z = 0 = 2x - 5y + 7$ and $y + 3z - 2 = 0 = x + 2z + 5$

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23. Prove that the lines $x = az + b, y = cz + d$ and $x = a_1z + b_1, y = c_1z + d_1$ are perpendicular if $aa_1 + cc_1 + 1 = 0$.

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24. Find the points of intersection of the line $\frac{x-1}{1}=\frac{y+2}{3}=\frac{z-1}{-1}$ and the plane $2x+y+z=9$.

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25. Find the co-ordinates of the point where the line joining $(3, 4, -5)$ and $(2, -3, 1)$ meets the plane $2x+y+z-7=0$.

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26. Find the distance of the point $(-1, -5, -10)$ from the point of intersection of the line $\frac{x-2}{2} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $x - y + z = 5$.

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27. Find the image of the point $(2, -1, 3)$ in the plane $3x - 2y + z - 9 = 0$

Watch Video Solution

28. Show that the lines $\frac{x+3}{2}=\frac{y+5}{3}=\frac{z-7}{-3}$ and $\frac{x+1}{4}=\frac{y+1}{5}=\frac{z+1}{-1}$ are co-planar.

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29. Prove that the lines $\frac{x+4}{3}=\frac{y+6}{5}=\frac{z-1}{-2}$ and $3x-2y+z+5=0=2x+3y+4z-4$ are co-planar.

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30. Show that the lines $7x - 4y + 7z + 16 = 0 = 4x + 3y - 2z + 3$ and $x - 3y + 4z - 6 = 0 = x - y + z + 1$ intersect. Find the coordinates of their point of intersection and equation of the plane containing them.

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31. Show that the line joining the points $(0, 2, -4)$ and $(-1, 1 - 2)$ and the lines joining the points $(-2, 3, 3)$ and

$(-3, -2, 1)$ are co-plannr. Find their point of intersection.

Watch Video Solution

32. Show that the line $\frac{x-1}{1} = \frac{y+2}{3} = \frac{z-1}{-1}$ lies on the plane $2x + y + 5z = 5$.

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33. Find the angle between the plane $x + y + 4 = 0$ and the line $\frac{x+3}{2} = \frac{y-1}{1} = \frac{z+4}{-2}$.

Watch Video Solution

34. Find the angle betweenthe plane $4x + 3y + 5z - 1 = 0$ and line $\frac{x+3}{2} = \frac{y-1}{3} = \frac{z+4}{6}$

Watch Video Solution

35. Find the equation of the line passing through the point (1, 0, -1) and intersecting the lines

$x = 2y = 2z, 3x + 4y - 1 = 0 = 4x + 5z - 2.$

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36. A line with direction ratios $< 2, 1, 2 >$ meets each of the lines $x = y + a = z$ and $x + a = 2y = 2z$. Find the co-ordinates of the points of intersection.

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37. Obtain the co-ordinates of the foot of the perpendicular drawn from the point $(3, -1, 11) \rightarrow thel \in e$x/2=(y-2)/3=(z-3)/4` Obtain the equation of the perpendicular also.

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38. Find the perpendicular distance of the point $(-1, 3, 9)$ from the line $\frac{x-13}{5} = \frac{y+8}{-8} = \frac{z-31}{1}$

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39. Find the distance of the point $(1, -2, 3)$ from the plane $x - y + z = 5$, measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$

Watch Video Solution

40. Find the distance of the point $(1, -1, -10)$ from the line $\frac{x-4}{1} = \frac{y+3}{-4} = \frac{z+1}{7}$ measured parallelto the line $\frac{x+2}{2} = \frac{y-3}{-3} = \frac{z-4}{8}$

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41. Find the equation of plane through the point $(2, 0, -3)$ and containing the line $3x + y + z - 5 = 0 = x - 2y + 4z + 4$

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42. Find the equation of the plane containing the line $x + 2 = 2y - 1 = 3z$ and parallel to the line $x = 1 - 5y = 2z - 7$. Also find the shortest distance between the two lines.

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43. Find the equation of the two planes through the origin, parallel to the line $\frac{x-1}{2}=\frac{y+3}{-1}=\frac{z+1}{-2}$ and at a distance $\frac{5}{3}$ from it.

View Text Solution

44. Find the equation of the straight line perpendicular to the line

$\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-6}{7}$ and lyinng in the plane x - 2y + 4z - 51 = 0.

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45. Find the shortest distance between the lines $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $\frac{x+3}{-3} = \frac{y-7}{2} = \frac{z-6}{4}$ Find also the equation of the line of shortest distance.

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46. Show that the shortest distance between the lines $x + a = 2y = -12z$ and $x = y + 2a = 6z - 6a$ is 2a .

Watch Video Solution

47. Find the length and equation of the line of shortest distance between the lines $3x - 9y + 5z = 0 = x + y - z$ and $6x + 8y + 3z - 13 = 0 = x + 2y + 2 - 3$

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Odisha Bureau S Textbooks Solutions Additional Exercise

1. Find the equation in vector and Cartesian from of the plane passing through the point $(3, -3, 1)$ and norrmal to the line joining the points $(3, 4, -1)$ and $(2, -1, 5)$

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2. Find the vector equation of the plane whose Cartesian from of equation is $3x - 4y + 2z = 5$

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3. Find the distance between the parallel planes $r.\left(2\hat{i}-\hat{j}-2\hat{k}\right)=6$ and $r.\left(6\hat{i}-3\hat{j}-6\hat{k}\right)=27.$

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4. Find the equation of the line joining the points. (1,4,-3) and (3,-1,0).

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5. Prove that the acute angle between the lines whose direction cosines are given by the relation $l + m + n = 0$ and $l^2 + m^2 - n^2 = 0$ and $\frac{\pi}{3}$

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6. Prove that three lines drawn from origin with direction cosines proportional to $(1, -1, 1), (2, -3, 0), (1, 0, 3)$ lie on one plane .

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7. Determice k so that the lines joining the points $p_1(k, 1-, 1)$ and $P_2(2k, 0, 2)$ shall be perpendicular to the line from P_2 to $P_3(2+2k, k, 1)$.

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8. Find the angle between the lines whose direction ratios are proportional to a,b,c and b-c,c-a,a-b,.

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9. O is the origin and A is the point (a,b,c). Find the equation of the plane through A at right angles to $\overrightarrow{OA}$.

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10. Find the equation of the plane through (6,3,1) and $(8, -5, 3)$ parallel to x-axls.

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Chapter Practice

1. The x-coordinate of a point on the line joining the points P(2,2,1) and Q(5,1,−2) is 4. Find its z-coordinate.

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2. Find the direction cosines of the line passing through two points (-2,4,-5) and (1,2,3).

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3. If a line has direction ratios 2, -1, 2, then determine its direction cosines.

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4. If P is a point in space such that OP = 12 and OP is inclined at angles of 45° and 60° with X and Y-axes, respectively. Then, find the position vector of P.

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5. Show that the lines $\frac{x-5}{7} = \frac{y+2}{-5} = \frac{z}{1}$ and $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ are perpendicular to each other.

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6. What is the angle between two planes $3x - 4y + 5z = 0$ and $2x - y - 2z = 5$?

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7. Write the direction cosines of the normal to plane $3x + 4y + 12z = 52$

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8. Find the cartesian equation of the plane $\vec{r}.\left[(s-2t)\hat{i} + (3-t)\hat{j} + (2s-t)\hat{k}\right] = 15.$

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9. What is the cartesian equation of the line $\vec{r} = \left(3\hat{i} - \hat{j} + 4\hat{k}\right) + \lambda\left(\hat{i} + 2\hat{j} + 3\hat{k}\right)$?

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10. Write the vector equation ofthe line given by $\frac{x-5}{3}=\frac{y+4}{7}=\frac{z-6}{2}$.

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11. Cartesian equation of line AB is $\frac{2x-1}{2}=\frac{4-y}{7}=\frac{z+1}{2}$. Write the direction ratios of a line parallel to AB.

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12. Find the equation of line passing through the point (2, 1, 3) having the direction ratios 1, 1, -2.

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13. Find the equation of a line parallel to Y-axis and passing through the origin.

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14. Find the coordinates of the point, where the line passing through (5, 1, 6) and (3, 4, 1) cross

YZ-plane.

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15. Write the condition for the lines $\vec{r} = \vec{a}_1 + \lambda \vec{b}_1$ and $\vec{r} = \vec{a}_2 + \lambda \vec{b}_2$ be intersecting.

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16. Find the equation of the plane passing through the point(-1,-1, 2) and perpendicular to

each of the planes $2x + 3y - 3z = 2$ and $5x - 4y + z = 6$.

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17. Find the equation of the plane passing through the intersection of the planes $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ and the point (2, 2, 1).

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18. Find the vector and cartesian equation of the line passing through the point (1, 2, 3) and parallel to the planes $\vec{r}.\left(\hat{i}-\hat{j}+2\hat{k}\right)=5$ and $\vec{r}.\left(3\hat{i}+\hat{j}+\hat{k}\right)=6.$

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19. Find the vector equation of the plane determined by the points A(3,-1,2), B(5, 2, 4) and C(-1,-1, 6). Also, find the distance of point P(6,5, 9) from this plane.

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20. Find the coordinates of the point where the line through the points A(3,4, 1) and B(5,1, 6) crosses the plane determined by the points P (2, 1, 2), Q(3,10) and R(4, -2,1).

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21. Find the point of intersection of the line $\frac{x-2}{1}=\frac{y+2}{3}=\frac{z-1}{-1}$ and the plane 2x+y+a=9

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22. Find the vector and cartesian equations of line passing through the point (1, 2 - 4) and perpendicular to two lines

$$\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7}$$ and $$\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}.$$

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23. Find the foot of the perpendicular from (1,6, 3) on the line $\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$.

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24. Prove the following by vector method. Measure of the angle between two diagonals of a cube is $\cos^{-1}\left(\frac{1}{3}\right)$

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25. Find the shortest distance between the lines $\vec{r} = 6\hat{i} + 2\hat{j} + 2\hat{k} + \lambda\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$ and $\vec{r} = -4\hat{i} - \hat{k} + \mu\left(3\hat{i} - 2\hat{j} - 2\hat{k}\right).$

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26. Find the shortest distance between the lines

$\vec{r} = \left(\hat{i} + 2\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right)$ and

$\vec{r} = \left(2\hat{i} - \hat{j} - \hat{k}\right) + \mu\left(2\hat{i} + \hat{j} + 2\hat{k}\right).$

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27. Find the shortest distance between the lines

$x + 1 = 2y = -12z$ and $x = y + 2 = 6z - 6.$

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28. Write the vector equations of the following lines and hence determine the distance between them $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z+4}{6}$ and $\frac{x-3}{4}=\frac{y-3}{6}=\frac{z+5}{12}$.

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29. Show that the lines $\vec{r}=3\hat{i}+2\hat{j}-4\hat{k}+\lambda\left(\hat{i}+2\hat{j}+2\hat{k}\right)$, $\vec{r}=5\hat{i}-2\hat{j}+\mu\left(3\hat{i}+2\hat{j}+6\hat{k}\right)$ are intersecting. And find their point of intersecting.

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30. Find the coordinates of the point, where the line $\frac{x+1}{2} = \frac{y+2}{3} = \frac{z+3}{4}$ meets the plane $x + y + 4z = 6$.

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31. Find the cartesian equation of the plane passing through the points A(0, 0, 0) and B(3,-1, 2) and parallel to the line $\frac{x-4}{1} = \frac{y+3}{-4} = \frac{z+1}{7}$

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32. Find the vector equation of the plane passing through the intersection of the planes $\vec{r}.\left(\hat{i}+\hat{j}+\hat{k}\right)=6$ and $\vec{r}.\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=-5$ and the point (1, 1, 1).

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33. write the direction cosine of the line whose direction ratios are{1,2,2}

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34. Find the value of k for which the following lines are perpendicular to each other $\frac{x+3}{k-5}=\frac{y-1}{1}=\frac{5-z}{-2k-1}$ and $\frac{x+2}{-1}=\frac{2-y}{-k}=\frac{z}{5}$. Also, find the equation of the plane containing the above lines.

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